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A LIST OF

THE ROTATORIA OF THE GREAT LAKES

AND OF SOME OF THE INLAND LAKES OF MICHIGAN

With Two Plates and Descriptions of Six New Species

By H S Jennings

Results of a Biological Examination of Lake St Clair Undertaken for the State Board of Fish Commissioners in the Summer of 1893 under the Supervision of J E Reighard

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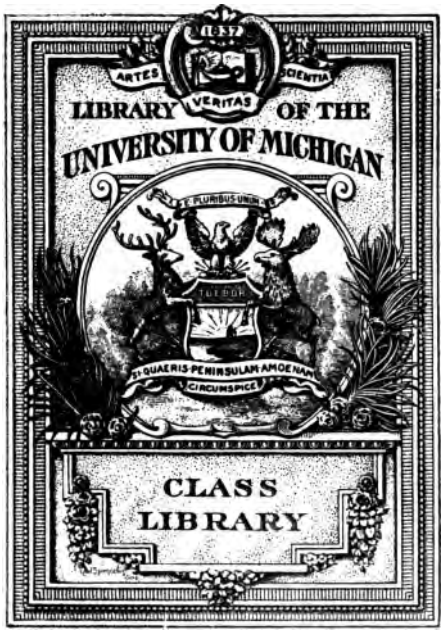
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ROTATORIA OF THE GREAT LAKES,

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SOME OF THE INLAND LAKES OF MICHIGAN.

The following is a list of the Rotatoria observed by me in Lake St. Clair and in some of the inland lakes of Michigan. The summer of 1892 was spent with a party of the employés of the State Fish Commission who were making a systematic examination of the inland lakes of Michigan, and I was able to determine some of the Rotifera of a number of the lakes in the western part of the State—in Muskegon, Newaygo, Oceana and Mecosta Counties. The summer of 1893 was spent in the State Fish Commission Laboratory at New Baltimore, on Lake St. Clair, and a more extended study was made of the Rotifera of this lake. The list makes no claim to completeness; scarcity of specimens or lack of time prevented accurate determination or complete description of many forms which I observed, and of course many have entirely escaped observation.

I have followed in the list the order used by Hudson and Gosse in their Monograph of the Rotifera and, except in two or three cases where they have been shown to be wrong, I have used their names and classification. For the species which have been described since the Mongraph was published (1889) I give the synonymy and references to the original descriptions. It has not seemed necessary to give synonymy or references for species described in Hudson and Gosse's work, except in cases where the synonymy here given differs from that of the Monograph. References are given by adding in parenthesis after the name of the author the date of the publication to which reference is made. At the end of the paper will be found the titles of the publications under an alphabetical list of the authors' names; to the titles are prefixed dates corresponding to those in the text.

Six of the 122 species noted are here described for the first time.

In the case of the smaller inland lakes, collections were made from the vegetation of the shore and bottom, but the tow net was little used, so that the pelagic Rotatoria of these lakes are not well represented in the list. In Lake St. Clair on the contrary the tow net was used systematically at various depths and at various distances from shore, so that for this lake the list of pelagic Rotifera may be considered nearly complete. The littoral rotatorial fauna of this lake was also examined with care, but no claim to

completeness is made for the list of these. The littoral Rotatoria studied were taken at or near New Baltimore, on the northwestern shore of the lake. The rotifers peculiar to sphagnums and similar marshy plants were not studied.

Fam. 1. FLOSCULARIADÆ.

Floscularia, Oken.

1. *F. ornata,* Ehrbg.

Chippewa L., Mecosta Co., abundant; L. St. Clair, not many.

2. *F. cornuta,* Dobie.

West Twin L., Muskegon Co.; pool near Stony L., Oceana Co.; L. St. Clair, on Utricularia. Not abundant.

3. *F. campanulata,* Dobie.

West Twin L., Muskegon Co.; McLaren L., Oceana Co. Not abundant.

4. *F. mutabilis,* Bolton.

Very common in towings from L. St. Clair, either at the surface or near the bottom.

5. *F. edentata,* Collins.

McLaren L., Oceana Co., abundant; less common in Chippewa L., Mecosta Co., and Crooked L., Newaygo Co.

6. *F. pelagica,* Rousselet. (93.)

Generally occurring in the towings from L. St. Clair, though but a few specimens each time; commonly in company with *F. mutabilis,* Bolton.

Apsilus, Metschnikoff.

7. *A. lentiformis,* Metsch.

Several specimens of the young free-swimming form occurring in the bottom tow from L. St. Clair, in company with *Asplanchna priodonta,* Gosse; *Anuræa cochlearis* Gosse, and other pelagic Rotifera. The adult form I have not seen.

Stephanoceros, Ehrbg.

8. *S. Eichhornii,* Ehrbg.

McLaren L., Oceana Co.; Horsehead L., Mecosta Co.; a single specimen from each.

Fam. 2. MELICERTADÆ.

Melicerta, Schrank.

9. *M. ringens,* Schrank.

West Twin L., Muskegon Co.; L. St. Clair. Exceedingly abundant in both localities on the under side of the leaves of the yellow water lily (*Nuphar advena*).

10. *M. Janus*, Hudson.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Horsehead L., Mecosta Co.; Chippewa L., Mecosta Co. Abundant, especially in the last named locality where its numerous tubes formed a continuous brown coating on the under side of the leaves of a Potamogeton.

Cephalosiphon, Ehrbg.

11. *C. limnias*, Ehrbg.

Abundant on algæ from the swampy shores of L. St. Clair.

Œcistes, Ehrbg.

12. O. *longicornis*, Davis.

McLaren L., Oceana Co.; L. St. Clair. Like Kellicott (88) I find that its tubes are not irregular, but compact, brown cylinders.

13. *O. Ptygura*, Ehrbg.

SYN.—*Ptygura Melicerta*, Ehrbg.; *Œcistes serpentinus*, Gosse; *Cephalosiphon furcillatus*, Kellicott (90).

Swamp on the shore of L. St. Clair, living in the floccose material collected between the bases of the rootlets on the under side of the fronds of Spirodela polyrrhiza. In most of the specimens the dorsal hooks were developed into two great branched antler-like structures, as described by Kellicott (90), in some however there were two simple hooks as described by Ehrenberg, Eckstein (83) and Gosse. I follow Bilfinger's account (Bilfinger 92) in placing *O. serpentinus*, Gosse, as one of the synonyms for this animal.

Magalotrocha, Ehrbg.

14. *M. alboflavicans*, Ehrbg.

Mona L., Muskegon Co.; Horsehead L., Mecosta Co.; L. St. Clair. In the last named lake it is exceedingly abundant, attached especially to Utricularia.

Conochilus, Ehrbg.

15. *C. volvox*, Ehrbg.

Chippewa L., Mecosta Co., among Utricularia. In L. St. Clair, very common among Utricularia near the shore; occurs rather sparingly in the material taken with the tow net at a distance from the shore; much less common than the next.

16. *C. unicornis*, Rousselet (92).

SYN.—*C. leptopus*, Forbes (93).

Very common in both surface and bottom tow, L. St. Clair. The only difference, apparently, between the English and American forms is that in England the eyes are described as red while in American specimens, from both the Yellowstone Park (Forbes 93) and L. St. Clair the eyes are black.

FAM. 3. PHILODINIDÆ.

Philodina, Ehrbg.

17. *P. roseola,* Ehrbg.

White L., Muskegon Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. One of the commonest of the Rotifera.

18. *P. citrina,* Ehrbg.

White L., Muskegon Co.; McLaren L., Oceana Co.; Crooked L., Newaygo Co.; L. St. Clair.

19. *P. megalotrocha,* Ehrbg.

L. St. Clair.

20. *P. aculeata,* Ehrbg.

McLaren L., Oceana Co.; L. St. Clair, in Vaucheria along the swampy shore; few.

21. *P. macrostyla,* Ehrbg.

SYN.—*P. tuberculata,* Gosse.

L. St. Clair, in water plants along the shore.

Rotifer, Schrank.

22. *R. vulgaris,* Schrank.

Found in most of the lakes that I have examined.

23. *R. tardus,* Ehrbg.

Occurring in very large numbers in Vaucheria from swampy shores of L. St. Clair.

24. *R. macroceros,* Gosse.

Few; in Vaucheria from swampy shore of L. St. Clair.

25. *R. trisecatus,* Weber.

L. St. Clair, amid Vaucheria; several specimens.

26. *R. mento,* Anderson (89).

Occurring in immense numbers in washings from Utricularia from the swampy shore of L. St. Clair, among the logs of a "log pen."

It is of great interest to find here this form, recently described from Calcutta, India. It has, I believe, not been reported since, except doubtfully and without notes in one of the lists of the Quekett Club collections in England (Journ. Quekett Club, July, 1893, p. 276). In Lake St. Clair it occurs by thousands, even in small quantities of the Utricularia washings.

As found here it is a large species, some specimens measuring .74 mm., and heavy in proportion to the length. In addition to the characteristics mentioned by Anderson, I note the following points.

The eyes are large and bear a distinct crystalline lens. The long antenna is composed of two joints, of which the proximal is much the longer; the terminal joint is broader at its distal end and bears three distinct bunches of setae, the middle one of which is elevated on a minute but distinct stalk. The foot is long and composed of five joints from toes to cloaca; it is generally telescopically retracted. The spurs are moderately short; the toes are minute and almost always retracted within the terminal joint of the foot; the middle toe is slightly longer than the others.

The material washed from the Utricularia is largely composed of the long brown tubes of this rotifer, turned together into great bunches. The tubes are very crooked, sometimes forked, and very long in proportion to the length of the animal; one which I measured was 2.5 mm. long. The rotifer remains always at the end of the tube, never so far as I have observed being found elsewhere than in this position, and continues to build out its tube apparently to an indefinite length. The process of forming the tube has I believe not been described. The animal stands with half or two-thirds of its body projecting from the tube, and unfolding its ciliary apparatus, a current of the minute particles in the water is driven down the ventral gap over the chin. Here the particles become imbedded in a gelatinous mass till a string of such particles imbedded in the gelatine is formed suspended from the chin. The animal then bends toward the ventral side and contracts till the mass is rubbed off on the edge of the tube. The process is somewhat different when the animal is starting a new tube, as it does at once after being dislodged from the old one. I have seen fourteen specimens thus engaged at the same time, under a single cover-glass. It attaches itself by the toes, unfurls its corona, and produces a current of particles as above described. About the neck is a ring of gelatinous material in which the particles are caught. This ring of gelatinous material is either shifted about by the contortions of the animal, or there is some means of distributing the particles which I could not observe, for the ring of gelatinous material soon becomes a collar of brown floccose, in which the particles are not heaped together at one point. The animal now retracts its corona, bends toward the ventral side and contracts strongly. The collar is thus forced back toward the foot, and by the formation of another collar in front of it, it is finally shoved back against the object to which the animal is attached. Besides the single stream from the gap of the coronal cup, particles are drawn in from all sides by the ciliary motion and just missing the edge of the corona, dash violently to the rear, where they are caught and held by the gelatinous collar. Flagellate infusoria of considerable size are sometimes in this way imbedded in the tube. Wandering rotifers sometimes become stuck in the forming tube also; I have seen Metopidia lepadella and Cathypna luna thus captured. The formation of the tube takes place very quickly at first, a tube of sufficient length to contain comfortably the whole animal being formed in half an hour.

27. *R. actinurus*, Ehrbg.

SYN.—*Actinurus neptunius*, Ehrbg.

L. St. Clair; rather common in the weeds along the shore and on the bottom.

I follow Janson (93), in placing this form in the genus Rotifer.

FAM. 5. MICROCODONTIDÆ.

Microcodon, Ehrbg.

28. *M. clavus*, Ehrbg.

Crooked L., Newaygo Co.; rare.

Microdides, Bergendal (92).

29. *M. orbiculodiscus*, Thorpe (91).

SYN.—*Rhinops orbiculodiscus*, Thorpe (91); *Microcodides dubius*, Bergendal (92).

Amid Cladophora from shores of L. St. Clair; a single gathering of this contained a considerable number, but I never found it again.

FAM. 6. ASPLANCHNADÆ.

Asplanchna, Gosse.

30. *A. priodonta*, Gosse.

Very abundant in L. St. Clair; taken in numbers in almost every tow, either surface or deep.

31. *A. Herrickii*, De Guerne. (See Wierzejski, 92.)

Towings from L. St. Clair; not abundant.

Ascomorpha, Perty. (**Sacculus,** Gosse.)

32. *A. ecaudis*, Perty (50).

SYN.—*Sacculus viridis*, Gosse.

Swampy portion of shores of L. St. Clair; few. Also a single specimen in surface towings from Whitmore L., Washtenaw and Livingston counties.

I use the above specific name and reference on the authority of de Guerne (88).

33. *A. hyalina*, Kellicott.

L. St. Clair, among weeds from the bottom; also a single specimen in the surface tow, one mile from shore. Numerous in towings from Whitmore L., Washtenaw and Livingston counties.

Anapus, Bergendal (92 and 93). **Chromogaster,** Lauterborn (93).

34. *A. ovalis*, Bergendal (92 and 93). *C. testudo*, Lauterborn (93).

Very common in towings from L. St. Clair and among the plants of the bottom.

It is difficult to tell what this animal should be called; apparently Bergendal's name was the first published, but almost without description; the first description being published by Lauterborn with the name Chromogaster testudo.

In regard to a number of points my study of this animal has gone more into detail than does the account of either Bergendal, Lauterborn or Zach-

arias (94) and it seems best on the whole to give the description and figures which I had prepared before I had seen the papers of those authors.

Animal without a foot, and possessing a lorica composed of two separate plates, dorsal and ventral, which are similar in form; between these at the sides a distinct gap. Length (in my specimens) about .135 mm.

As a whole the animal is lenticular in form, appearing broadly ovate in a dorsal or ventral view, and narrowly oval in a side view, as shown in the figures (1 and 2). The dorsal and ventral plates of the lorica differ little in form and size; the ventral plate extends somewhat farther backward, the dorsal plate farther forward. The anterior edge of the dorsal plate has a broad shallow notch on the left side, which was constant in all the considerable number of specimens examined with reference to it. At each side in front, in the angle between the dorsal and ventral plates of the lorica, there seems to be a separate small triangular piece, perhaps only a stiffened portion of the integument of the head. To each of these is attached a muscle; the two muscles run along the sides just outside the viscera and are attached to the posterior end of the lorica at the sides of the opening of the contractile vesicle. The two muscles thus attached give almost exactly the appearance figured by Bergendal, which he was inclined to explain as the side walls of the intestine, the point of attachment of the muscles being interpreted as the anus. Neither intestine nor anal opening was to be observed, so far as I can judge. The entire lorica is covered with minute polygonal areas; in front these are arranged in rows. These are not prominent and were overlooked by both Bergendal and Lauterborn. In the reproduction of my drawing these are rendered too distinct.

The corona is composed of the following parts: (*a*) two curved lateral lobes extending nearly to the mid dorsal line and bearing the greater part of the cilia; (*b*) two small bunches of cilia on the ventral surface, at either side of the point of the trophi; (*c*) a similar pair situated on either side of the middle line on the dorsal surface of the corona; (*d*) two thick two-jointed styles, curved ventrad when fully extended, situated at the anterior edge or curve of the corona—where the dorsal and ventral surfaces pass into one another. In some cases these styles seemed to bear at the end a number of stiff setæ; in other cases no setæ were visible. (*e*) A second pair of more slender styles situated dorsad of these. In all cases examined the two members of this pair differed. Each consists of a short proximal and long terminal joint, but the left style curves inward then outward, so as to make an arc of about 120 degrees, whereas the right hand one is straight and generally extends slightly inward, so as to make an acute angle with its neighbor of pair (*d*). These four styles (*d* and *e*) are retractile; so that unless the corona is well expanded they are not visible; often the corona is unfolded to such an extent that one pair is visible while the other is not. The animal may be killed with a very weak cocaine solution so as to show all four at the same time. (*f*) The last and most peculiar portion of the corona is a large flattened organ on the dorsal edge. It consists of a short thick club-shaped proximal joint, attached slightly to the right of the middle line, and a large thin leaf-like terminal joint, broadening to its distal end and curved strongly dorsad. The proximal joint often appears granular, but the distal joint is so thin as to be transparent, so that it requires accurate focussing to get its outlines; in an edge view it appears only as a line. Besides being curved dorsad it is slightly spirally curved. I have never seen it show any movement, except to be slowly bent in closer to the cor-

ona. The side view (Fig. 2) shows this organ in its natural position; in the ventral view it is turned out of place. This organ is evidently to be compared to the "spatula-shaped apex" described by Kellicott (88) for Ascomorpha hyalina, and the "lippenförmigen Fortsatz" of Bartsch's Ascomorpha saltans (Bartsch, 70). I was able to examine the organ in *A. hyalina* and find it very similar to that of the present species.

The trophi are forcipate; the stomach lies transversely across the body and is divided into three principal portions—a transverse portion, and projecting forward from it at the sides two lateral lobes, so that the whole is somewhat U shaped. These lobes are constricted into many minor lobules, which contain large solid masses, orange, yellow and black in color, giving the animal a variegated appearance on a groundwork of light yellow. Concerning the origin and distribution of these colored bodies in the stomach, details are given by Lauterborn. Projecting forward from the two anterior lobes of the stomach are two small pointed colorless gastric glands.

The contractile vesicle lies at the posterior end of the body, nearer the ventral surface; it is somewhat pear shaped, the pointed end reaching to the opening on the dorsal surface, apparently between the plates of the lorica. Its period is about 15 seconds. Closure may be seen to take place by pushing in of the ventral wall of the vesicle, not by a contraction from all sides. A small oval opening to the outside is visible at the time of the collapse of the vesicle. The lateral canals are hidden by the lobes of the stomach; two flame cells may be seen on each side—one a little behind the middle of the anterior lobes of the stomach, the other behind the middle of the posterior lobe.

The brain is simple and bears at its caudo-dorsal angle a small dark eye.

The movement of the animal through the water is a quick spiral motion, turning on its axis and rapidly progressing forward. Its course is interrupted at intervals by short periods of rest, during which the corona is retracted. It is possible that the spiral motion is connected with the spiral turn of the spatula-shaped appendage of the corona.

Zacharias (94) considers this a member of the genus Ascomorpha, and the relationship is certainly very close. If that genus is to be divided, it seems probable that *A. ecaudis*, Perty, and *A. agilis*, Zacharias (93) on the one hand, should be separated from *A. saltans*, Bartsch, *A. hyalina*, Kellicott, and the present species on the other. The two former agree in the lack of a lorica and in the simple ciliary wreath, the latter in the presence of a lorica, and of a large dorsal process on the corona.

Fam. 7. SYNCHAETADÆ.

Synchaeta, Ehrbg.

35. *S. pectinata,* Ehrbg.

Abundant in towings from Whitmore L., Washtenaw and Livingston counties; taking the place here which is occupied in L. St. Clair by *S. stylata,* Wierzejski.

36. *S. stylata,* Wierzejski (93).

Very abundant in towings from L. St. Clair.

Wierzejski's account of this animal is brief and, as I have seen it, is in the Polish language, so that it may be well to give a description here.

In general appearance it resembles in some degree *S. pectinata*, but it is immediately distinguished by the long slender foot.

The corona differs from that of *S. pectinata* in that the two "club shaped prominences" or "Kämme" of *S. pectinata* are represented here by a single central prominence, bearing two bunches of setæ; also in some minor respects. It consists of the following parts: (*a*) a dorsal and a ventral row of cilia, not continuous with each other along the sides. Each of these is interrupted in the middle line. (*b*) A wreath of exceedingly minute immobile cilia-like processes on the dorsal border of the mouth; (*c*) a slight distance to each side of the mouth a group of four large setæ. These are arranged in two pairs, each pair coming from a single base and its two members differing in size. (Wierzejski figures these as five on each side, raised on an elevation, but his figure is apparently diagrammatic in this respect.) (*d*) Laterad of the cilia—between the ciliary crown and the auricle and about midway between the dorsal and ventral edges of the corona, a long style on each side. (*e*) A similar but shorter pair of styles arising from the dorsal edge of the corona, nearer the middle. (*f*) Two large rounded auricles in a similar position to those of *S. pectinata*. (*g*) A central conical projection bearing two brushes of stiff setæ, separated by a median space. The setæ stand at a considerable angle with the axis of the elevation, and are directed ventrad. (Wierzejski does not show these setæ forming two brushes.) Wierzejski figures in addition to these parts, two separate bunches of cilia at each side of the mouth and dorsad of it, somewhat as described by Plate (85) for *S. pectinata*; these after long study seem to me to be only incurved lateral portions of the ventral row of cilia, but I could not be certain.

The mastax is very large, the trophi complicated, of the ordinary Synchaeta type. A slender œsophagus connects the mastax with the stomach, which is provided with a pair of small gastric glands. The brain is ovate and bears a large red eye. The contractile vesicle is small and lies at the posterior end of the body. The lateral canals are distinct, passing along each side as a nearly straight tube, from the contractile vesicle nearly to the fore part of the stomach. Here it forms a coil, from which arise, by a common stalk, two flame cells. The canal passes thence to the base of the auricle, where there is another flame cell; farther than this I could not trace it.

The ovary is distinctly formed of two portions—one containing a number (about 8–12) of large nuclei; the other finely granular. The latter portion contains generally a small reddish orange, irregular, granular mass.

The whole body has generally a pinkish hue, the mastax is commonly violet, the stomach yellow. The outline in side view varies much in different specimens; in most the lateral diameter is considerably greater than the dorso-ventral, but sometimes the animal is swollen so that a section would be nearly a circle. A side view shows a dorsal antenna in the usual position.

The slender foot is about one-third the length of the remainder of the body; the toes are minute.

Fam. 8. TRIARTHRADAE.

Polyarthra, Ehrbg.

37. *P. platyptera,* Ehrbg.

Chippewa L., Mecosta Co., among weeds near shore; Whitmore L., Washtenaw and Livingston counties, in towings. Perhaps the commonest of all rotifers in L. St. Clair, occurring everywhere—in towings far from shore, among the plants of the bottom, and among those along the shore.

Fam. 9. HYDATINADAE.

Notops, Hudson.

38. *N. laurentinus, n. sp.* (Figs. 3 and 4.)

This animal bears considerable resemblance to *Triphylus lacustris,* Ehrbg., and to *Dinops longipes,* Western (91) but its structure places it in the genus *Notops.* The corona, like that of *N. hyptopus* is a single ciliary wreath, without styligerous prominences, and without styles or other processes of any kind.

In general form the animal resembles the two above mentioned species. But the foot is larger and less sharply set off from the body and the body is scarcely so distinctly "humped," coming thus nearer the Notommatadæ in form. The foot does not arise from the ventral surface, but at the posterior end of the body nearer the ventral surface; it is composed of a very short proximal and long distal joint, the latter bearing two very short conical toes, which are pressed together. The toes are retractile within the foot and the entire foot is retractile within the body. The body is dorsally arched, the height of the arch differing much in different specimens; the ventral line is slightly convex. The head is distinctly marked off from the body; its anterior surface is an oblique disk on which is a single marginal row of cilia. The head bears near its junction with the body a minute dorsal antenna, which is connected with the anterior part of the brain by two nerve threads, each of which has an enlargement close to the outer end.

The brain is an oblong body, bluntly pointed behind and bearing at the point a small round eye, which is generally red, but sometimes appears black and sometimes is nearly colorless, so that it might be overlooked.

The mastax is three lobed; the trophi are weak and forcipate, resembling those of *N. hyptopus* as figured by Hudson. The mastax is followed, without the intervention of an œsophagus by a long saccate stomach. This commonly fills about the dorsal two-thirds of the body cavity—though its size varies with the amount of contents. When it contains food it is distinctly separable into stomach proper and intestine. Two small flat oval gastric glands lie at the sides of the anterior end of the stomach.

The ovary is a broad, slightly curved band lying obliquely across the ventral surface—the left end lying farther to the rear than the right end. The form and size vary much with the condition of growth—absence or presence of developing eggs, etc.

There is a large contractile vesicle lying ventrad of the intestine; from it the lateral canals pass forward as a single fine tube on each side. At

the side of the ovary each forms a complicated coil bearing a flame cell; it then passes to the front edge of the ovary, where there is another flame cell; crosses the gastric gland and passes on to the sides of the mastax, where another flame cell is found. There is another flame cell in the anterior part of the head.

The general appearance of this animal varies considerably owing to great differences in thickness of the body as compared with the length.

The average length is about .22 to .25 mm.

Common among the plants of the bottom and shore of L. St. Clair.

39. *N. pygmaeus*, Calman (92).

SYN.—*Hudsonella picta*, Zacharias (93); *Gastropus stylifer*, Imhof (?) (88).

L. St. Clair; Whitmore L., in Washtenaw and Livingston counties; very abundant in towings and in the vegetation of the bottom.

Ploesoma, Herrick.

40. *P. lynceus*, Ehrbg.

SYN—*Euchlanis lynceus*, Ehrbg.; *Ploesoma lenticulare*, Herrick (85); *Gomphogaster areolatus*, Vorce (87); *Gastropus Ehrenbergii*, Imhof (88); *Gastroschiza lynceus* (Ehrbg.) Bergendal (92*a*); *Gastroschiza foveolata*, Jägerskiöld (92;) *Bipalpus lynceus*, (Ehrbg.) Wierzejski and Zacharias (93).

I have discussed the synonymy of this form at greater length in the Zoölogischer Anzeiger of Feb. 19, 1894.

This animal is fiercely predaceous in habits; I have seen *Synchaeta stylata*, *Notommata truncata*, and various other large rotifers fall a prey to *Ploesoma*. In every case the prey was seized by the side of the head, and the inner soft parts were drawn into the stomach of the captor, the remainder of the body being then dropped.

One of the commonest rotifers in L. St. Clair—in towings and among the weeds of the bottom and shore; also in Crooked L., Newaygo Co., and Chippewa L., Mecosta Co.; a few specimens from each.

41. *P. Hudsoni*, Imhof (88).

SYN.—*Gastroschiza flexilis*, Jägerskiöld (92); *Bipalpus vesiculosus*, Wierzejski and Zacharias (93); *Dictyoderma hypopus*, Lauterborn (?) (93).

L. St. Clair; rare, a few specimens in the bottom and surface tows and among the weeds of the bottom.

FAM. 10. NOTOMMATADAE.

Albertia, Dujardin.

42. *A. naidis*, Bousfield.

L. St. Clair; three specimens squirming about in the bottom of a dish that contained Nitella from the lake. There were many annelids in the dish and no doubt the rotifers came from some of these.

Taphrocampa, Gosse.

43. *T. annulosa,* Gosse.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Not uncommon in the algæ near the shore.

44. *T. Saundersiae,* Gosse.

L. St. Clair, in Nitella from the shore; rare.

45. *T. selenura,* Gosse.

Many in Vaucheria from the shore of L. St. Clair.

Pleurotrocha, Ehrbg.

46. *P. constricta,* Ehrbg.

From a small pool near L. St. Clair. True to its nature as figured by Ehrenberg, the specimen was attached by its jaws to a Stylaria and maintained its hold during the entire time it was under observation.

Notommata, Gosse.

47. *N. aurita,* Ehrbg.

L. St. Clair; in plants from the bottom; not common.

48. *N. tripus,* Ehrbg.

White L., Muskegon Co.; L. St. Clair. Among the plants of the shore; few.

49. *N. brachyota,* Ehrbg.

In Vaucheria from swampy shores of L. St. Clair; rare.

50. *N. lacinulata,* Ehrbg.

Abundant in nearly all waters.

51. *N. collaris,* Ehrbg. (?)

L. St. Clair, on Utricularia.

This is the form described under this name by Gosse, agreeing with his measurements as given in the Monograph.

52. *N. torulosa,* Dujardin.

Chippewa L., Mecosta Co.; very abundant among Utricularia. L. St. Clair, in Vaucheria from swampy portions of the shore.

53. *N. monopus,* n. sp. (Figs. 5 and 6.)

Fusiform, truncate in front, where the circular corona is surrounded by a crenate fringe, tapering behind to a single pointed toe. Two large spherical stalked auricles. On each side of the body, at about the middle of its length, a large rounded projection, with a small opening in the top. A single red eye. Two dorsal antennæ, one on each side of the eye, two minute lateral antennæ at the beginning of the posterior third of the body. Animal exceedingly versatile and larva like; of a deep slightly brownish

red color. Length, .15 mm. Width across the lateral projections when the animal is moderately contracted .06 mm.

The above is a summary of the more important characteristics of this peculiar animal, which differs in several marked features I believe from any of the previously described *Notommatae*. The most notable of these peculiarities are, the single foot, the perforated lateral projections, and the crenate fringe surrounding the corona.

The corona is scarcely at all oblique. The two auricles are like those described by Cohn for *N. torulosa*; they arise from the circular ciliate face just on either side of the middle line. The crenate fringe seemed sometimes to be minutely ciliate, though I could not be certain of this.

The two large lateral projections are perhaps the most striking characteristic. They are rounded and bear an opening in the apex; in an animal which had been slightly compressed a portion of the internal contents was observed to project through these openings.

The single pointed toe is preceded by a single short joint.

The brain is large and is minutely striated longitudinally. The posterior border is pigmented, and imbedded in the black pigment is a large bright red eye. The two dorsal antennæ are situated at either side of the eye, in such way that a side view shows distinctly a single one of them, apparently in the median line, so that the fact that there are two is easily overlooked. Each bears a bunch of setæ. The lateral antennæ are exceedingly minute; they are situated in the ordinary position, considerably behind the large lateral projections above described.

The mastax is very small; I did not succeed in studying the trophi carefully. A short œsophagus leads from the mastax to a very large stomach. This is divided a little behind the middle by a deep constriction into two dissimilar portions. The anterior part is thick walled and lobulate, and its inner surface is covered with minute villous processes; it continually undergoes a sort of peristaltic contraction. The posterior part is a thin walled sack, always dilated, so far as I have observed, not partaking of the contractions of the front part. The two parts differ in color; the anterior in cases noted was orange red, the posterior cherry red.

At either side of the anterior portion of the stomach, just in front of the lateral projections, are a number—generally about ten to twelve—of small spherical orange brown strongly refractive bodies, imbedded in a transparent mass. This seems to be attached to the stomach and may represent the gastric gland.

Beneath the stomach is the long ovary, and behind this is the small contractile vesicle.

The animal, like most pelagic species, is generally in active motion, and incessantly changing its form. The drawings give the form when freely swimming and fairly extended; it is often much shorter and thicker. Almost any small part of the body may be much contracted, so as to leave two large parts connected by a narrow neck. Especially often the body is deeply constricted immediately behind the two lateral projections, less often just in front of them. Sometimes constriction takes place in both these regions at once, so that the projections sink deep below the level of the remainder of the body, giving the animal a strange wasp like form.

L. St. Clair; in towings, both surface and deep; not abundant, though a few occurred in almost every take.

54. *N. truncata*, n. sp. (Figs. 10 and 11.)

Cylindrical or somewhat club shaped in form, truncate in front, the last third tapering gradually to end abruptly, with two short conical toes. Color of the entire animal a deep orange brown. The ciliate face is prone and very long (.10 mm. in an animal .28 mm. in length); it extends from the ventral surface over the anterior end and a very slight distance onto the dorsal surface. Two very large auricles are frequently exposed; these are produced in front each into a small clear rounded projection as shown in the figure. Posteriorly the body falls off suddenly at the cloaca to a short flattened portion that may be called the foot, lying along the ventral line of the body; to it are joined two short conical toes, which are commonly somewhat divergent in direction and separated by a distinct notch.

A striking feature is the brain; this in dorsal view is somewhat ovate; squarely truncate at its posterior end; in front tapering slightly to a rounded anterior end. All this portion is clear; immediately against the posterior end of the brain, and generally though not always marked off from it by a distinct line, is a large, often somewhat hemispherical, mass of granules, very dark red in color—almost black by transmitted light, bright red by reflected light. This mass is so opaque that in the majority of cases no eye is distinguishable, but in a single specimen out of perhaps forty examined as to this point, I could see by strong transmitted light a distinct clear red spherical body in the center of the mass, doubtless an eye. The dorsal antenna is represented by a minute bunch of very fine setæ situated on the top of the head just in front of the eye and connected with a slight elevation of the brain. No lateral antennæ could be seen.

The mastax and trophi are very large; the trophi are forcipate, thick and heavy, and are continually snapping, often reaching forward outside the buccal orifice. The mastax is followed by a short, narrow œsophagus, which lies immediately behind the brain and is rendered visible, in a dorsal view, by its marked ciliary motion. At the sides of this are the large gastric glands broader at the posterior end. The stomach is very large, crowded close up against the mastax and gastric glands, and fills the whole breadth of the body. The walls of the stomach are slightly wrinkled; they are very thick and are filled with yellowish granules. The inner surface is strongly ciliate. At about the anterior end of the contractile vesicle the intestine begins; it has thick but transparent walls which are ordinarily apposed, so that the cavity is obliterated. At the posterior end, behind the place where the contractile vesicle opens into it, there is a slight dilation to form a cloaca. It opens at the marked dorso-caudal angle of the body, above the foot.

The ovary is large, lying in the ordinary position. There is a large foot gland which extends into the body as far as the posterior end of the contractile vesicle.

The contractile vesicle is oblong and very large, filling a considerable portion of the posterior part of the body; its relation to the lateral canals shows some peculiar features. There is a flame cell in the head region, at the side of the mastax, but I could not trace its connection with the lateral canal. The next flame cell lies at the dorsal surface of the gastric gland. From this the lateral canal passes downward to the middle of the gland, then curves caudad and passes along the side of the ovary, near the anterior end of which is another flame cell. The lateral canal passes then straight

back to the front end of the contractile vesicle, where there is on each side another flame cell. Thus far the canals of the two sides are alike, but posterior to this their courses differ. From the flame cell of the right side the right lateral canal passes to the dorsal surface of the vesicle, lying to the right of the middle line, and extends thus to a little behind the middle of the vesicle. Here it makes a sharp curve to the right and passes around to the ventral surface of the vesicle, then backwards and inwards nearly to the middle line, where it is joined by a canal coming on the ventral surface from the front of the vesicle—sometimes slightly on the left side of the middle line. The canal formed by the junction of these two passes back to the end of the vesicle, and curves about the end to the left side, where it is seen to be continuous with the left lateral canal. This passes from the left flame cell directly back along the ventro-lateral surface of the vesicle to the point of union. The point of origin of the ventral canal, which lies between these two and joins the right canal as above described, could not be determined; it could be traced to the anterior end of the vesicle, but no further; possibly it opens into the vesicle at that point.

In specimens observed the period of the contractile vesicle varied from two and a half to three and a quarter minutes. It opens into the intestine at some distance from the posterior end of the latter. The end of the intestine may be seen to dilate at the time of the contraction of the vesicle.

The animal is rather slow and clumsy in its movements.

Very common in the bottom vegetation of L. St. Clair.

Copeus, Gosse.

55. *C. labiatus,* Gosse.

Among the water plants of the swampy shore of L. St. Clair; few.

56. *C. Cerberus,* Gosse.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Among water plants near the shore.

Proales, Gosse.

57. *P. sordida,* Gosse.

Common among the bottom plants of L. St. Clair.

58. *P. felis,* Ehrbg.

In Vaucheria from L. St. Clair; few.

59. *P. Werneckii,* Ehrbg.

Inhabiting galls and filaments of Vaucheria, from the shores of L. St. Clair; (also from a rivulet at Ann Arbor).

Furcularia, Ehrbg.

60. *F. forficula,* Ehrbg..

McLaren L., Oceana Co.; Chippewa L., Mecosta Co.; Round L., Mecosta Co.; L. St. Clair.

In several specimens from L. St. Clair I observed that what seems in side view to be the proximal *one* of the apparently two teeth on the toe, really consisted of three minute points forming a transverse row across the

base of the toe; and in a single very large specimen that it consisted of a row of five or six minute points. The distal tooth was single in all these cases.

61. *F. gracilis*, Ehrbg.
L. St. Clair; swampy shores.

62. *F. gibba*, Ehrbg.
Chippewa L., Mecosta Co.; L. St. Clair; rare.

63. *F. longiseta*, Ehrbg.
White L., Muskegon Co.; McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Very common.

Eosphora, Ehrbg.
64. *E. aurita*, Ehrbg.
In Utricularia and Nitella from L. St. Clair; not common.

Diglena, Ehrbg.
65. *D. grandis*, Gosse.
L. St. Clair, in Utricularia; not common.

66. *D. forcipata*, Ehrbg.
Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Rather common.

67. *D. circinator*, Gosse.
Chippewa L., Mecosta Co.; few.

68. *D. caudata*, Ehrbg.
McLaren L., Oceana Co.; not uncommon.

69. *D. biraphis*, Gosse.
Chippewa L., Mecosta Co.; L. St. Clair.

Many other species of this family, belonging especially to *Notommata*, *Copeus* and *Diglena*, were observed, but it seems to be necessary to observe great caution in identifying the species here with those described from Europe, as forms which are similar in a cursory view show great differences on a more exact study. I have mentioned only those in which the determination is certain; of those not identical with European forms, I have described but two (Nos. 52 and 53).

Fam. 11. RATTULIDAE.

Mastigocerca, Ehrbg.
70. *M. carinata*, Ehrbg.
West Twin L., Muskegon Co.; Crooked L., Newaygo Co., (the ruby col-

ored variety mentioned by Kellicott, 88); Chippewa L., Mecosta Co.; L. St. Clair. In algæ near the shore.

71. *M. bicornis*, Gosse.
Chippewa L., Mecosta Co.; L. St. Clair; littoral.

72. *M. bicuspes*, Pell (90).
A single specimen from among Utricularia; shores of L. St. Clair.

73. *M. capucina*, Wierzejski and Zacharias (93).
SYN.—*M. Hudsoni*, Lauterborn (93).
A single specimen from the bottom tow; L. St. Clair.

At least four other species of this genus were observed, none of which could be certainly identified with any described form. Only one of these was carefully studied; the description and figure are given herewith (No. 74). Of the others, one is a form with two large dorsal keels, like *M. bicristata*, Gosse, and perhaps it should be identified with that form. But the two ridges do not extend "nearly the whole length of the dorsum," only very slightly beyond the middle, and the animal as a whole is not of the shape shown in Gosse's figure, but is shorter and broader in proportion to the length; Gosse's description is so meager otherwise that it is impossible to determine whether or not this form is the same as his. It was observed in Crooked L., Newaygo Co.; Chippewa L., Mecosta Co., and in L. St. Clair; in the latter it was very abundant in the bottom vegetation. Another, from Crooked L., Newaygo Co., is a large form which I was inclined to call *M. scipio*, Gosse, but it is considerably larger than Gosse's specimens, is brightly colored instead of colorless, and differs in some other small particulars. The other two were very unlike any described form; the following is a description of one of these.

74. *M. lata, n. sp.* (Fig. 7.)

Lorica broadly ovate in dorsal or ventral view, the width being about five-eighths of the length. The dorso-ventral measurement is about half to two-thirds of the width, so that the animal is dorso-ventrally somewhat depressed. The dorsal line is a uniform curve from the *front* of the head to the *base* of the large *foot joint;* the ventral line is a similar but less convex curve from the *junction of the head and body* to the base of the *toe*, so that the two curves are not symmetrically placed. The lorica is peculiarly unsymmetrical in a dorsal or ventral view, for the posterior part of the body—what I have called the foot joint—is a thick truncate cone lying, not in the middle line, but on the left side, so that the outline of the left side of the body is a uniform curve, while the right side has a great break at the junction of this foot joint and the body (See Fig. 7). The lorica ends in front on the ventral side in a broad notch at the bottom of which is a projecting tooth. There is likewise a slight notch at the anterior dorsal margin.

The toe is a slender pointed rod continuing the curve of the left side of the lorica; it is about four-fifths the length of the body. It is accompanied by three short unequal styles, the longest about one-fifth the length of the toe, the others much shorter. The toe is united to the lorica in

such a way that it can be turned to the right and ventrad, but cannot be turned to the left nor dorsad.

The corona consists of the following parts; (*a*) a dorsal and lateral fringe of cilia, forming about two-thirds the circumference of the head; (*b*) at the middle of the dorsal edge a flattened non-setigerous column, truncate at the end; (*c*) ventrad of *b* a similar flattened process, slightly narrower in the middle than at its two ends, and bearing at its free end a pair of minute curved processes. Ventrad and laterad of this are (*d*) a pair of slender, somewhat club-shaped processes, curving ventrad. At either side of the middle of the corona are (*e*) four small papillæ, the two inner of which, at least, bear long setæ. These are partially surrounded by (*f*) an incomplete circle of cilia.

The mastax is oblong, truncate at either end, and not so long as is common in the genus; its circular end appears in a ventral view in front of the broad pectoral notch of the lorica. The internal organs partake of the peculiar asymmetry that appears in the lorica. The stomach is curved and lies to the right of the middle; its walls contain many large spherical light yellowish refractive granules. But one of the small gastric glands is visible in dorsal or ventral view; whether another exists I cannot say. The ovary lies to the left of the stomach, not ventrad of it. The contractile vesicle is large, lying just behind the middle of the lorica. At the posterior end of the body, to the right of the attachment of the toe is another small clear vesicle, pear shaped in form, perhaps also connected with the excretory system. The lateral canals of the left side lie ventrad of the ovary and present three flame cells, one at the side of the posterior end of the mastax, one at the side of the front end of the stomach, and one just in front of the contractile vesicle. The lateral canals of the right side, if there are such, were not observed.

The brain is irregular and ill defined; in the specimen in which it was studied it ended behind in several apparently detached pieces—from one of which a small tube (perhaps representing a dorsal antenna) projected dorsad through the lorica. On the dorsal surface of the main body of the brain is the eye, formed of a large clear sphere imbedded in a deep red cup.

L. St. Clair; common among the algæ near the shore.

Rattulus, Ehrbg.

75. *R. sulcatus, n. sp.* (Fig. 8 and 8*a*.)

Body truncate in front, tapering slightly from about the middle to a pointed posterior end; curved so that the dorsal line forms nearly an arc of a circle. Lorica constricted by two deep grooves, passing around it about one-third the length of the animal from the head. The two toes very short, slender, tapering; curved ventrad, often to such an extent as not to be visible in a dorsal view; almost entirely retractile within the lorica. They are a slight distance apart at the base, and incline toward each other so that the distal ends generally touch. A fleshy lobe extends from the dorsal portion of the corona, rectangular in dorsal view, triangular as seen from the side.

The mastax is very large, reaching back nearly to the middle of the body, and is distinctly striated transversely. The trophi are of the type characteristic of this family. The stomach is a simple sac, tapering from the front to the cloaca, granular and often dark green in color; the gastric

glands are small and clear. The ovary and contractile vesicle are in the ordinary position.

The brain extends backward nearly to the anterior of the two rings and bears on the ventral surface of its obtusely pointed posterior end a large red eye.

The species is separated from any described form by the deep constrictions of the lorica and by the short slender toes.

Very common in vegetation from the bottom of L. St. Clair.

Coelopus, Gosse.

76. *C. porcellus,* Gosse.

Pool near shore of Stony L., Oceana Co.; Crooked L., Newaygo Co.; L. St. Clair. Common in algæ.

Fam. 12. DINOCHARIDAE.

Dinocharis, Ehrbg.

77. *D. pocillum,* Ehrbg.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Not uncommon among algæ.

78. *D. tetractis,* Ehrbg.

Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Rather more common in L. St. Clair than the last.

Polychaetus, Perty.

79. *P. subquadratus,* Perty.

L. St. Clair; a single specimen in the surface tow.

This animal has been carefully figured and described by Ternetz (92), which renders unnecessary a further account here. I follow Ternetz in considering *Polychaetus* and *Dinocharis* separate genera.

Scaridium, Ehrbg.

80. *S. longicaudatum,* Ehrbg.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Common in the vegetation of shore and bottom.

81. *S. eudactylotum,* Gosse.

Chippewa L., Mecosta Co., amid Utricularia. One specimen.

Stephanops, Ehrbg.

82. *S. muticus,* Ehrbg.

Pool near Stony L., Oceana Co.; Chippewa L., Mecosta Co.; L. St. Clair. Abundant in the latter lake in Nitella.

Fam. 13. SALPINADAE.

Diaschiza, Gosse.

Numerous species belonging to this genus were observed; all varied from described forms, except the following.

83. *D. semiaperta*, Gosse.

Common in the vegetation of the bottom of L. St. Clair.

Salpina, Ehrbg.

84. *S. brevispina*, Ehrbg.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Abundant in Utricularia and Lemna.

85. *S. ventralis*, Ehrbg.

Chippewa L., Mecosta Co.; L. St. Clair. Abundant in a swampy portion of the lake, containing Spirodela polyrrhiza.

86. *S. macrocera, n. sp.* (Figs. 12 and 13.)

This very striking form may be distinguished from any other species by the following combination of characters:

Occipital spines very long and broad, procurved, movably jointed to the lorica; pectorals about half as long; no spines at the posterior end of the lorica.

No other described species is without lumbar and alvine spines and no other is described as having the occipital spines movably jointed to the lorica. These occipital spines are about two-thirds the length of the lorica and are commonly held as shown in the figure (dorsal view), but I have seen them held for a long time *crossed*, and at such an angle sometimes that the crossing took place nearer the lorica than the middle of the length of the spines.

In general form the lorica is depressed and nearly triangular in section—the ventral side of the triangle convex, the other two flat and inclined toward one another so that they would meet above the median dorsal fissure. The posterior end of the lorica is entirely smooth. At the base of the great occipital spines the edge of the lorica projects upward in two small sharp points. Both ends of the lorica have a narrow collar, to the anterior one of which the spines are jointed. Both spines and collar are minutely stippled; the collars are continuous rings—not interrupted at the dorsal gap, like the rest of the lorica. The edges of the lorica are marked on each side by four clear spots at about equal distances apart.

The head is very large and may be protruded far outward and downward between the pectoral spines, the mastax being carried with it, or it may be retracted entirely within the lorica. Its natural position when the animal is at rest is slightly protruded, about as shown in the dorsal view. A dorsal antenna projects between the bases of the occipital spines, and just behind it on the brain lies a large red eye. The foot is long, composed of five to seven joints, and contains two long foot glands; to it are joined two long, tapering toes. The foot may be completely retracted within the lorica.

When not protruded in feeding the mastax lies behind the brain, just in front of the middle of the lorica. The stomach is formed of many lobes and pouches; on either side in front it bears two large gastric glands. The ovary is in the ordinary position. No contractile vesicle could be distinguished.

The animal is slow, rarely swimming freely, but creeping about in the algæ.

Length of lorica, including spines, about .25 mm.

The very distinct and striking characteristics of this form seem to justify its description from a single example.

A single specimen from among Utricularia in a marshy portion of Chippewa L., Mecosta Co.

Fam. 14. EUCHLANIDAE.

Euchlanis, Ehrbg.

87. *E. lyra,* Hudson.

L. St. Clair, among plants from the bottom; few.

This is such a well marked species that I can hardly hesitate to identify my specimens with it, even though they differ from Hudson's description in one marked particular—there is a distinct though shallow notch in the posterior edge of the dorsal plate of the lorica. In other respects the agreement is complete.

88. *E. dilatata,* Ehrbg.

West Twin L., Muskegon Co.; White L., Muskegon Co.; pool near shore of Stony L., Oceana Co.; Crooked L., Newaygo Co,; Chippewa L., Mecosta Co.; L. St. Clair. Common in the vegetation of the bottom and shores.

89. *E. deflexa,* Gosse.

Chippewa L., Mecosta Co.; L. St. Clair, in Chara from the bottom.

90. *E. triquetra,* Ehrbg.

McLaren L., Oceana Co.; Chippewa L., Mecosta Co.; L. St. Clair, in the vegetation of the shores and bottom.

91. *E. oropha,* Gosse.

L. St. Clair; several specimens in the bottom tow, a mile and a half from shore.

92. *E. parva* Rousselet (92).

L. St. Clair; common in the vegetation of the shores and bottom.

Fam. 15. CATHYPNADAE.

Cathypna, Gosse.

93. *C. luna,* Ehrbg.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Very common.

94. *C. ungulata,* Gosse.

L. St. Clair; not rare among algæ of the shore, especially common in Vaucheria.

95. *C. leontina*, Turner (92).

This is a large species, of about the same size as *C. ungulata*, the total length being .30 mm., the whole length of the lorica, .20 mm. The form of the lorica is that of the other species of *Cathypna*, almost exactly that of *C. luna*, except that the posterior end extends in a broad quadrate plate over the foot. A further specific distinction is found in the toes, which are very long (the total length being .11 mm.), narrow and straight; each ends in a distinct claw on the inner side and a minute point on the outer side.

L. St. Clair; not abundant, yet not especially rare in Vaucheria and other algæ near the shore.

Distyla, Eckstein.

96. *D. Ludwigii*, Eckstein.

L. St. Clair, in Vaucheria from swampy shores; rare.

97. *D. ohioensis*, Herrick (85).

Crooked L., Newaygo Co.; L. St. Clair. Not uncommon in Chara and Vaucheria of the shores.

98. *D. Stokesii*, Pell (90).

(*Cathypna Stokesii*, Pell.)

Chippewa L., Mecosta Co.; L. St. Clair, in Utricularia and Vaucheria.

This by its general form seems to me to belong unquestionably rather to *Distyla* than *Cathypna*.

There are other species of *Distyla* to be found in the algæ of our lakes, differing from each other and from various described forms in characters often minute—demanding more time to separate and determine them than I have had at command.

Monostyla, Ehrbg.

99. *M. lunaris*, Ehrbg.

West Twin L., Muskegon Co.; pool near shore of Stony L., Oceana Co.; McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Very common in algæ of the bottom and shores.

100. *M. cornuta*, Ehrbg.

West Twin L., Muskegon Co.; White L., Muskegon Co.; L. St. Clair. In bottom and shore vegetation.

101. *M. bulla*, Gosse.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Common with the last.

102. *M. quadridentata*, Ehrbg.

Crooked L., Newaygo Co.; L. St. Clair. Common in the bottom and shore vegetation.

103. *M. mollis*, Gosse.

L. St. Clair; swampy shore, amid Spirodela polyrrhiza.

104. *M. closterocerca*, Schmarda. (?) (Fig. 9.)

Not uncommon in Vaucheria and other algæ from the bottom of L. St. Clair.

As shown in the figure the general form is similar to that of *M. lunaris*, the lorica being perhaps slightly longer in proportion to the breadth. The characteristic point is the broadly spindle shaped foot, bearing a short claw at the end. As this is also the characteristic feature in Schmarda's *M. closterocerca*, my specimens are probably identical with his; some minor disagreements being due to the general inaccuracy and incompleteness of Schmarda's work. Thus the form of the foot is not exactly the same as will be seen by comparing the two figures; the eye is not "very small" for an animal of this size, and of course the trophi are not "triangular maxillæ"—though by dividing the mastax lengthwise they might easily be imagined to be such, as they might in almost any *Monostyla*.

Fam. 16. COLURIDAE.

Colurus, Ehrbg.

Species of this genus are abundant, but most differ in minute characters from described forms; I give herewith the only one which I observed to show perfect agreement with a described form.

105. *C. bicuspidatus*, Ehrbg.

Chippewa L., Mecosta Co., in Utricularia.

Metopidia, Ehrbg.

106. *M. lepadella*, Ehrbg.

McLaren L., Oceana Co.; L. St. Clair. Very abundant.

107. *M. acuminata*, Ehrbg.

Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. In the vegetation of the shores and bottom, not uncommon in L. St. Clair.

108. *M. rhomboides*, Gosse.

Chippewa L., Mecosta Co.; a single specimen in Utricularia.

109. *M. bractea*, Ehrbg.

McLaren L., Oceana Co.; L. St. Clair.

110. *M. triptera*, Ehrbg.

Pool near shore of Stony L., Oceana Co.; McLaren L., Oceana Co.; Crooked L., Newaygo Co.; L. St. Clair. Abundant in water from about the St. Clair Flats.

111. *M. Ehrenbergii*, Perty (52).

SYN.—*Notogonia Ehrenbergii*, Perty (52); *Metopidia angulata*, Anderson (89); *M. Notogonia*, Ternetz (92).

McLaren L., Oceana C.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. In algæ near the shores; rare.

Cochleare, Gosse.

112. *C. turbo*, Gosse.

Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. In shore vegetation; rare.

FAM. 17. PTERODINADAE.

Pterodina, Ehrbg.

113. *P. patina*, Ehrbg.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. Common among the plants of the shores.

In L. St. Clair I found a form like *P. patina* but smaller, the length of the lorica being .158 mm.; the dorsal plate has a rounded projection in front, forming an arc of about 120 degrees—like that of *P. intermedia*, Anderson (89) but not so marked.

114. *P. reflexa*, Gosse.

McLaren L., Oceana Co.; Crooked L., Newaygo Co.; Chippewa L., Mecosta Co.; L. St. Clair. One of the commonest of the Rotifera in the vegetation of the shores.

115. *P. bidentata* Ternetz (92). *P. emarginata*, Wierzejski (92*a*).

L. St. Clair; in Nitella from near the shore. The animals were abundant in this one gathering; otherwise I have never seen them.

Which of the two names given above has the priority, I am not able to say.

FAM. 18. BRACHIONIDAE.

Brachionus, Ehrbg.

116. *B. Bakeri*, Ehrbg.

Chippewa L., Mecosta Co.; L. St. Clair. A variety with very long lateral spines behind; also, there are *three* teeth or small spines about the foot orifice, one dorsal and two lateral.

117. *B. militaris*, Ehrbg.

L. St. Clair; rather common among the plants along the shore.

Noteus, Ehrbg.

118. *N. quadricornis*, Ehrbg.

Chippewa L., Mecosta Co.; L. St. Clair, in Lemna and Utricularia near the shore.

Fam. 19. ANURAEADAE.

Anuraea, Gosse.

119. *A. aculeata*, Ehrbg.

Four empty loricas, in surface towings from L. St. Clair. A single living specimen from Whitmore L., Washtenaw and Livingston counties.

120. *A. serrulata*, Ehrbg.

L. St. Clair, in Nitella from near the shore; few.

121. *A. cochlearis*, Gosse.

McLaren L., Oceana Co.; Crooked L., Newaygo C.; Chippewa L., Mecosta Co.; L. St. Clair. One of the most abundant of the Rotifera in towings from the latter lake.

Notholca, Gosse.

122. *N. longispina*, Kellicott.

Chippewa L., Mecosta Co.; a single specimen. In L. St. Clair, very abundant in towings; a few in towings from Whitmore L., Washtenaw and Livingston counties.

Of the 122 rotifers named in the list, 110 are found in L. St. Clair, while 12 were found in the smaller inland lakes and not in L. St. Clair. Forty-nine were found in L. St. Clair and not elsewhere; sixty-one were noted both in L. St. Clair and in other lakes.

As to the distribution within the lakes, detailed observations were made only on L. St. Clair. Here the species may be separated with some distinctness into two classes; (1) strongly swimming forms, commonly found in the open water at a distance from shore; (2) littoral or bottom forms, which are found among the vegetation of the shores and bottom. The first may be conveniently designated as pelagic, the second as littoral. It is to be noted that the pelagic rotifers are to be found also with the others amid the vegetation of the bottom and near the shores, except in swampy places. The littoral species also are not confined to the region of the shore, but owing perhaps to the shallowness of L. St. Clair, are many of them to be found among the plants of the bottom in almost any part of the lake; they are not however to be found like the pelagic species, swimming freely in the open water or near the surface.

Of the 110 named species from L. St. Clair, nineteen may be distinguished as pelagic; to these may be added an undetermined species of *Synchaeta;* so that the total number of pelagic species observed in L. St. Clair is twenty. These are the following:

Floscularia mutabilis, Bolton.
Floscularia pelagica, Rousselet.
Apsilus lentiformis, Metschn. (young.)
Conochilus volvox, Ehrbg.
Conochilus unicornis, Rousselet.
Asplanchna priodonta, Gosse.
Asplanchna Herrickii, DeGuerne.
Ascomorpha hyalina, Kellicott.
Anapus ovalis, Bergendal, Chromogaster testudo, Lauterborn.
Synchaeta stylata, Wierzejski.
Synchaeta (species undetermined).
Polyarthra platyptera, Ehrbg.
Ploesoma lynceus, Ehrbg.
Ploesoma Hudsoni, Imhof.
Notops pygmaeus, Calman.
Notommata monopus, n. sp.
Mastigocerca capucina, Wierz. and Zach.
Anuraea aculeata, Ehrbg.
Anuraea cochlearis, Gosse.
Notholca longispina, Kellicott.

The most abundant pelagic species are Polyarthra platyptera, Ehrbg., Anuraea cochlearis, Gosse, and Asplanchna priodonta Gosse, so that in this respect there is a general agreement with the condition found in European lakes. These three species occur in great numbers and their presence is almost constant in towings taken at a considerable distance from shore. Little less abundant are Notholca longispina, Kellicott, Synchaeta stylata, Wierz., Notops pygmaeus, Calman, Ploesoma lynceus, Ehrbg., and Anapus ovalis, Bergendal (Chromogaster testudo, Lauterborn).

The remainder are less frequent. Ascomorpha hyalina, Kellicott, and Mastigocerca capucina, Wierz. and Zach. were each observed but once in the towings; Anuraea aculeata, Ehrbg., is admitted to the list only on the strength of the occurrence of four empty loricas in the tow; the living animal was not seen at all. A noteworthy circumstance is the occurrence of young specimens of Apsilus lentiformis, Metsch.; these were met several times though the adult attached form was never seen. A single dead specimen of Polychaetus subquadratus, Perty—the only specimen seen—was taken in one of the surface towings, but this is hardly sufficient data for giving this as a pelagic form. The undetermined species of Synchaeta is not S. pectinata, and probably not S. tremula; it is a very small species and is rare, so that I did not study it.

The remaining ninety-one species from L. St. Clair may be classified as littoral or bottom forms; regarding their distribution the accounts of the different species may be consulted.

In so far as it is possible to judge from my incomplete studies of the inland lakes (those not in direct connection with the Great Lakes) their littoral Rotatorial fauna is identical with that of L. St. Clair.

The pelagic rotifers of the inland lakes were not studied, except in the case of Whitmore Lake, in Washtenaw and Livingston counties. Here some towings were taken in the spring of 1894, for comparison with the condition found in L. St. Clair. Whitmore L. is a small inland lake, about two miles long and one mile wide, with a greatest depth of about fifty-five feet. The water is very clear, the bottom of sand or gravel, and at the time the towings were taken, almost entirely without bottom vegetation. It is unconnected with the Great Lakes, and indeed has no visible inlet or outlet. In this lake the following pelagic rotifers were found:

Ascomorpha ecaudis, Perty; a single specimen.
Ascomorpha hyalina, Kellicott; rather numerous.
Synchaeta pectinata, Ehrbg.; very abundant.
Synchaeta (species undetermined, the same as in L. St. Clair); few.
Polyarthra platyptera, Ehrbg.; few.
Notops pygmaeus, Calman; very abundant.
Anuraea aculeata, Ehrbg.; a single specimen.
Notholca longispina, Kellicott; few.

Leaving out of account the perhaps accidental occurrence of the single specimen of Ascomorpha ecaudis, Perty, this list, as far as it goes, contains the same species as that for L. St. Clair, with one peculiar exception. In place of the very abundant Synchaeta stylata, Wierz. of L. St. Clair, there is found here in equal abundance the common European species Synchaeta pectinata, Ehrbg. What may be the meaning of this peculiar variation I am unable to indicate; it will be interesting to observe whether this distinction between the Great Lakes and the inland lakes is maintained throughout, or whether this is only an isolated case, or whether again the difference in the time of the year in which the towings were taken has any connection with the variation.

Distinctively pelagic rotifers were met accidentally also in some of the other inland lakes; I have recorded the occurrence of Conochilus volvox, Ehrbg.; Ploesoma lynceus, Ehrbg., Polyarthra platyptera, Ehrbg., Anuraea cochlearis, Gosse, and Notholca longispina, Kellicott, in Chippewa L., Mecosta Co.; of Ploesoma lynceus, Ehrbg. and Anuraea cochlearis, Gosse, in Crooked L., Newaygo Co.; and of Anuraea cochlearis, Gosse, in McLaren L., Oceana Co. As the tow net was not used in these lakes, lack of observation of other species does not indicate their absence.

A circumstance worthy of note is the fact that Lacinularia socialis, Ehrbg. and Hydatina senta, Ehrbg., two of the commonest rotifers almost everywhere, according to all reports, were never observed in any of the waters examined by me. Both however have been reported from Michigan by Kellicott (88), though not as lacustrine.

It may be well, in order to facilitate reference, to give here a list of the new species described in this paper, with their numbers in the text. These are the following:

Notops laurentinus. (38.)
Notommata monopus. (53.)
Notommata truncata. (54.)
Mastigocerca lata. (74.)
Rattulus sulcatus. (75.)
Salpina macrocera. (86.)

MORPHOLOGICAL LABORATORY,
UNIVERSITY OF MICHIGAN,
April 23, 1894.

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Of these papers, that referred to under Perty (50) I have not seen; the others I have had at hand.

EXPLANATION OF THE FIGURES.

The following abbreviations are common to several of the figures:

br. = brain.
cv. = contractile vesicle.
da. = dorsal antenna.
e. = eye.
fg. = foot gland.
gg. = gastric gland.
la. = lateral antenna.
lc. = lateral canal.
m. = muscle.
mx. = mastax.
ov = ovary.
tr. = trophi.

For explanation of the lettering of the corona in figures 1 and 7, see the description of those forms in the text.

PLATES 1 AND 2.

Through an error the two plates have been combined into one.

Fig. 1. Anapus ovalis, Bergendal—Chromogaster testudo, Lauterborn, ventral view.
Fig. 2. The same, side view.
Fig. 3. Notops laurentinus, n. sp. dorsal view.
Fig. 4. " " side view.
Fig. 5. Notommata monopus, n. sp., dorsal view.
Fig. 6. " " side view.
Fig. 7. Mastigocerca lata, n. sp., ventral view.
Fig. 8. Rattulus sulcatus, n. sp., side view.
Fig. 8*a*. " " ventral view of toes.
Fig. 9. Monostyla closterocerca, Schmarda (?), ventral view.
Fig. 10. Notommata truncata, n. sp., dorsal view.
Fig. 11. " " side view.
Fig. 12. Salpina macrocera, n. sp., dorsal view.
Fig. 13. " " side view of lorica.

Figs. 1, 2, 7, 8, 8*a*, and 9 with camera lucida; the others free-hand. The drawings were made in pencil by the author; they were afterward *enlarged by* the aid of the pantagraph and inked by Mr. J. I. Conklin. *From these enlargements* the photographic reproductions were made.